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RECEIVED 19 May 2024

ACCEPTED 21 August 2024

PUBLISHED 13 September 2024

CITATION

Daskalaki E, Soto-Corominas A, Xia VY and Paradis J (2024) The role of parental characteristics, home language use, and schooling in children's Mandarin heritage language development in Canada. *Front. Lang. Sci.* 3:1435200. doi: 10.3389/flang.2024.1435200

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The role of parental characteristics, home language use, and schooling in children's Mandarin heritage language development in Canada

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Introduction: This study on child HL (heritage language) speakers of Mandarin examines the associations between parental characteristics (attitudes and proficiency), children's HL use (at home and through schooling), and children's HL outcomes (in vocabulary and simple syntax).

Methods: Forty-seven Mandarin-English bilingual children of Chinese heritage (mean age: 10.5; age range: 6.8–16.2) residing in Western Canada participated in the study. All children were second-generation immigrants, and received one of three types of schooling. There were 11 children who attended English-only schools (*English school* group), 21 who attended English-only schools but also after-school heritage Mandarin classes (*Heritage school* group), and 15 who attended English-Mandarin bilingual schools (*Bilingual school* group). The children were administered two tasks: a picture-naming task targeting Mandarin vocabulary (LITMUS-CLT) and an experimental elicitation task targeting Mandarin *wh*-interrogative sentences (an early-acquired structure). Parents were administered a questionnaire about home language environment, attitudes toward Mandarin transmission, and their children's schooling choices.

Results: Results showed that positive parental attitudes and lower parental proficiency in English were associated with more Mandarin use at home. More Mandarin use at home, in turn, was associated with larger vocabularies and more accurate production of interrogatives. By contrast, school type was only associated with vocabulary and not syntax: the Bilingual school group had larger vocabularies than the English school group.

Discussion: Overall, these results show how parental characteristics may influence input factors, which in turn may differentially affect the acquisition of vocabulary vs. early-acquired syntactic structures.

KEYWORDS

HL schooling, HL home language use, parental attitudes, parental proficiency, vocabulary, syntax, Mandarin

Introduction

Child heritage speakers (HSs) are early bilinguals, whose heritage language (HL), the language they use at home with their family, differs from the majority language (ML) of the society they live in (Rothman, 2009; Montrul, 2016, 2022, 2023; Polinsky, 2018). Because they typically acquire their HL under reduced input conditions and with limited or no formal instruction, they become dominant in the ML, while they show high individual variation in their HL abilities (Montrul, 2022; Paradis, 2023).

Research on the sources of individual differences in HSs has been growing rapidly (Armon-Lotem and Meir, 2019; Paradis, 2023). Nevertheless, most of the existing studies have focused on the role of home language use. Comparatively fewer studies have examined how HL use at home interacts with HL schooling in shaping HL outcomes; how HL use at home and HL schooling affect different language domains; or how they may be affected by distal factors, such as the parents' characteristics (e.g., their own attitudes and proficiencies; Paradis, 2023). These questions relate to theoretical discussions concerning the differential vulnerability of language domains to fluctuations in the HL input (Montrul, 2022, 2023; Chondrogianni, 2023), as well as to more applied concerns related to language practices at home and school selection.

Accordingly, the aim of the present study is to examine associations between parental characteristics (attitudes and proficiency), HL use (at home and through schooling), and HL outcomes in a group of school-age, Mandarin-English bilingual children, who are second-generation immigrants in western Canada. To examine whether the relative contribution of HL experiences at home and at school depends on the target domain, we will focus on outcomes in both vocabulary (an open-ended domain) and *wh*-questions (an early-acquired structure). In what follows, we review the relevant studies on HL acquisition with a focus on the individual difference factors of interest. We also briefly review the properties of *wh*-questions in Mandarin.

Heritage language experiences in the home

Numerous studies have shown that the frequency with which children hear and use their HL at home affects their performance across a variety of HL domains, in different degrees. Input/output effects have been reported for vocabulary (e.g., Hammer et al., 2012; Hoff et al., 2012; Prevoo et al., 2014; Gagarina and Klassert, 2018; Czapka et al., 2021; Chondrogianni and Daskalaki, 2023; Paradis et al., 2024), phonology (e.g., Ruiz-Felter et al., 2016), morphology (e.g., Flores et al., 2017b; Rodina and Westergaard, 2017; Chondrogianni and Schwartz, 2020), syntax (e.g., Jia and Paradis, 2020; Paradis et al., 2021; Daskalaki et al., 2022), and syntax-discourse (e.g., Daskalaki et al., 2019).

Paradis et al. (2024), for instance, collected data from Arabic-English bilingual children, who were first-generation immigrants in Canada. They found that 5 years post-migration, language use with siblings, along with other environmental factors, predicted children's abilities on an Arabic vocabulary and an Arabic sentence repetition task. Chondrogianni and Daskalaki (2023) reported similar results for Greek-English bilingual children, who were second- and third-generation immigrants in North America (US and Canada). In particular, they found that more frequent Greek use with family members (parents, grandparents, and siblings) was associated with higher vocabulary scores in Greek and with a higher rate of grammatical post-verbal subjects (VS) in interrogatives. Interestingly, vocabulary was further boosted by HL input external to the home (trips to the homeland), whereas the acquisition of syntactically conditioned word order was solely dependent on home language use.

Heritage language experiences at school

In addition to HL experiences at home, HL experiences at school may also contribute to building stronger HL abilities, especially for structures and vocabulary items that are less likely to appear in colloquial registers (Pires and Rothman, 2009). This is because HL schooling increases not only the amount of HL use, but also the richness of HL use through exposure to different registers as well as through interactions with diverse speakers (teachers and peers; Flores et al., 2017a; Montrul, 2022, p. 58; Paradis, 2023). Indeed, an increasing number of studies report that the type and the amount of HL schooling may affect HL outcomes above and beyond home language use (Gathercole, 2002; Montrul and Potowski, 2007; Bylund and Díaz, 2012; Kupisch et al., 2014; Jia and Paradis, 2015; Mattheoudakis et al., 2016; Andreou et al., 2020; Rodina et al., 2020; Paradis et al., 2021; Armstrong and Montrul, 2022; Soto-Corominas et al., 2022; Torregrossa et al., 2023).

HL schooling may take a variety of forms. For HSs who are first-generation immigrant children, schooling may have occurred back in the home country before migration, when the now-HL had ML status. In the current society of residence, HL schooling can include after-school HL classes, in which the HL is the object of instruction; and bilingual schools, in which the HL is used along with the ML as the medium of instruction. There is evidence that both types may be beneficial. Bylund and Díaz (2012), for example, found that Spanish-Swedish bilingual children (HSs of Spanish) who attended after-school HL classes in Sweden at the time of testing outperformed children who no longer did so. The authors concluded that extra-curricular HL classes may confer an advantage, but that this advantage might not be long-lasting. Gathercole (2002) investigated the effect of bilingual schools on Spanish-English bilingual children (HSs of Spanish) in Miami. She found that these bilingually educated children exhibited stronger abilities in Spanish morphosyntax than children attending mainstream, English-only schools. Finally, Jia and Paradis (2015) found an interesting interplay between Mandarin HL richness activities (a measure encompassing activities such as frequency of reading Mandarin books and watching Mandarin TV shows) and schooling. Based on data from Mandarin-English bilingual children who attended either English-only or Mandarin-English bilingual schools in Edmonton, Canada, they found that HL richness activities only showed significant, positive effects for children attending English schools. The result was taken to suggest that the influence of Mandarin-English bilingual schools washed out the influence of HL richness activities.

The role of parental attitudes and proficiency

The studies reviewed so far reveal a robust relationship between HL acquisition and HL experiences (at home and at school). What are the distal factors, however, that shape children's experiences with their HL? This question has received comparatively little attention in individual differences approaches to bilingualism (for an overview, see Paradis, 2023). It is reasonable to assume that parental characteristics, such as parental attitudes and HL/ML

proficiency, play a key role in this regard (Pearson, 2007). Parents with more positive attitudes concerning HL transmission might be more inclined to use the HL at home and to seek extra support through HL schooling (if this is available). As well, HL/ML parental proficiency may also affect language use. To take two extreme examples, for first-generation parents with minimal or no proficiency in the ML, using the ML is not an option; these parents will use exclusively or mostly the HL with their children. Conversely, second-generation parents with minimal or no proficiency in the HL will use exclusively or mostly the ML at home. Very few studies have explored the role of parental attitudes and proficiency empirically, and the ones that have done so have yielded mixed results.

Parental attitudes toward the HL

Gathercole and Thomas (2007), based on data collected from Welsh-speaking parents in Wales, found that parents had overall very positive attitudes toward Welsh. However, their attitudes were not associated significantly with the language spoken to/by the child. By contrast, Altman et al. (2014), based on sociolinguistic interviews with first-generation Russian immigrant parents in Israel, found significant correlations between parental pro-Russian ideologies and Russian language use (as perceived by their children). Finally, Hollebeke et al. (2023) surveyed immigrant families in the Flemish Community of Belgium, finding only a weak positive correlation between parents' beliefs in the benefits of multilingualism in children and their efforts to maximize their child's exposure to the HL. The authors speculated that the lack of stronger effects might be due to the linguistic diversity of their sample, which comprised 100 different HLs. They also point out that their survey questions on the benefits of child multilingualism had limited scope, since they did not include topics such as benefits in job opportunities.

Parental HL/ML proficiency

Turning to parental proficiency, Hammer et al. (2012), based on data collected from 191 Latino families in the US, found that mothers' ratings of their own proficiency in English were associated with children's vocabulary abilities in Spanish. In particular, mothers with lower English proficiency had children with higher Spanish vocabulary scores. Similarly, Gathercole and Thomas (2007) found that Welsh parents' own language proficiency was associated with the language that parents used when speaking to their children and the language that children used when talking with their parents. In particular, mothers with a higher confidence in Welsh were more likely to use Welsh in child-mother interactions. The same was true for fathers; that is, fathers with a higher confidence in Welsh were more likely to use Welsh in child-father interactions.

Wh-questions in Mandarin Chinese

In our study we focus on child HSs of Mandarin in western Canada and test their performance in two distinct domains:

vocabulary, an open-ended domain, and *wh*-questions, an early-acquired structure that can nevertheless be vulnerable to cross-linguistic influence from English (Daskalaki et al., 2023). We review here the properties of Mandarin *wh*-questions, with an emphasis on their differences from English. Subsequently, we discuss their acquisition by monolingual and heritage populations.

The structural properties of *wh*-questions in Mandarin Chinese and English

Mandarin Chinese is predominantly SVO, and adjuncts modifying events typically appear before the lexical verb (Mai and Deng, 2019). Some adjuncts, such as those denoting when an event occurred, can also be placed at the front of the sentence. As an example, see (1a) and (1b)¹:

- | | | |
|--------|--|----------|
| (1) a. | Lǎoshi zuótiān kànjiàn-le | Zhāngsān |
| | teacher yesterday see-PFV | Zhangsan |
| | “Yesterday, the teacher saw Zhangsan.” | |
| b. | Zuótiān lǎoshi kànjiàn-le | Zhāngsān |
| | yesterday teacher see-PFV | Zhangsan |
| | “Yesterday, the teacher saw Zhangsan.” | |

Wh-questions follow the same word order as declaratives (Huang et al., 2009, chapter 7). That is, *wh*-words remain *in-situ*: subject *wh*-words are preverbal (2), object *wh*-words are post-verbal (3), and *when*-adjuncts² are preferably preverbal (4a). In colloquial registers, however, fronting of *when*-adjuncts may occur (4b), much like their temporal counterpart in declaratives.

- | | |
|--------|--|
| (2) | Shéi kànjiàn-le Zhāngsān? |
| | who see-PFV Zhangsan |
| | “Who saw Zhangsan?” |
| (3) | Zhāngsān kànjiàn-le shéi? |
| | Zhangsan see-PFV who |
| | “Who did Zhangsan see?” [Huang et al., 2009, ex. 89] |
| (4) a. | Zhāngsān shénme shíhòu kànjiàn-le lǎoshī? |
| | Zhangsan what time see-PFV the teacher |
| | “When did Zhangsan see the teacher?” |
| b. | Shénme shíhòu Zhāngsān kànjiàn-le lǎoshī? |
| | what time Zhangsan see-PFV the teacher |
| | “When did Zhangsan see the teacher?” |

In this regard, Mandarin differs from English. English is a *wh*-movement language in which *wh*-words occur sentence-initially, independently of whether they function as a subject (5), object (6), or adjunct (7).

- | | |
|-----|------------------------------------|
| (5) | Who saw Zhangsan? |
| (6) | Who did Zhangsan see? |
| (7) | When did Zhangsan see the teacher? |

1 The following abbreviations appear in the interlinear glosses: PFV, perfective; CONT, continuous; PROG, progressive.

2 Note that *when* in Mandarin is actually a compound composed of *shénme* “what” + *shíhòu* “time.” It will be glossed as such in the examples.

Given the differences between the positions of *wh*-words in Mandarin and English interrogatives, Mandarin *wh*-questions can be a potential site for observing cross-linguistic influence, as discussed in our next section.

The acquisition of *wh*-questions

Turning to the acquisition of *wh*-questions, studies with monolingual children have shown that *wh*-questions emerge early in child Chinese (for Mandarin, see Erbaugh, 1982, chapter 5; Miao, 1986; Erbaugh, 1992; Miao and Zhu, 1992; for Cantonese, see Cheung, 1995). Per Miao and Zhu (1992), Miao (1986) examined monolingual children's comprehension of *wh*-questions. The author found that by the age of three, children were able to answer *shéi* "who," *shénme* "what," and *nǎlǐ* "where" questions, and by the age of four, they were able to answer questions containing *shénme shíhòu* "when" and *zěnmé* "how." Correct responses to *wèishénme* "why" questions appeared later on, around the age of five. Similarly, Erbaugh (1982), based on a longitudinal study of two Mandarin-speaking children (aged two), reported that *wh*-questions were used correctly and productively from very early on. By the age of three, the children had produced well-formed questions with a wide range of *wh*-words, including (in order of frequency): *shénme* "what," *zěnmé* "how," *nǎlǐ* "where," *shéi* "who," *wèishénme/gànmá*³ "why," *něi-gè* (also written as *nǎ-gè*) "which," and *shénme shíhòu* "when" (Erbaugh, 1982, p. 461). The author proposes multiple reasons for the early and unproblematic acquisition of Chinese questions, including, among others, their high frequency in child-adult interactions, as well as their transparent word order that fully aligns with the word order of declaratives.

Less straightforward is the acquisition of Chinese *wh*-questions by Chinese-English bilingual children. Case studies on naturalistically collected data have reported (sporadic) instances of ungrammatical *wh*-fronting under cross-linguistic influence from English (for Cantonese, see Kwan-Terry, 1986; Yip and Matthews, 2000, 2007). More recently, Daskalaki et al. (2023) conducted a larger-scale experimental study with school-aged Mandarin-English bilingual children, who speak Mandarin as an HL in western Canada. Using an elicited production task, the authors found that bilingual children sometimes produced fronted *wh*-words not only in Mandarin *when*-questions, where *in-situ* is preferred, but also, to a lesser degree, in Mandarin object-questions, where *in-situ* is required. In both question types, the rate of *wh*-fronting increased as a function of the child's level of dominance in English.

In the present study, we extend this line of research by asking how HL use at home and at school impacts HS children's Mandarin *wh*-questions, which is a site for cross-linguistic influence (CLI) from English.

³ *Gànmá* literally means "do what" and is a colloquial variant of *wèishénme* in some contexts.

Present study

The present study sought to complement the existing literature by examining how children's HL experiences at home interact with HL experiences at school in determining HL acquisition outcomes; how these experiences have a differential effect depending on the target domain; and how they are shaped by distal factors, such as parental attitudes and proficiency. To this end, we collected data from Mandarin-English bilingual children in western Canada (Alberta). The children received three different types of schooling: English-only schools, English-only schools as well as after-school HL classes, or Mandarin-English bilingual schools. Participants were administered production tasks targeting vocabulary (an open-ended domain) and *wh*-questions (an early-acquired structure). Specifically, we asked the following research questions:

1. Do maternal/paternal attitudes and proficiency affect children's experiences with their HL? In particular:
 - a. Do they affect the amount of HL use in mother-child and father-child interactions at home?
 - b. Do they affect school selection?
2. Do home language use and schooling affect children's HL abilities? In particular:
 - a. Do they affect children's Mandarin vocabulary?
 - b. Do they affect children's Mandarin *wh*-questions?

With respect to the association between maternal/paternal characteristics and HL use at home (research question 1a), findings from existing studies are rather mixed, especially with respect to the role of attitudes. We hypothesize that if there is an association, then mothers with more positive attitudes about HL transmission and mothers with lower English proficiency will be more likely to use Mandarin with their children at home. Accordingly, fathers with more positive attitudes about HL transmission and fathers with lower English proficiency will be more likely to use Mandarin with their children at home. With respect to the association between parental characteristics and school selection (research question 1b), we hypothesize that parents with more positive attitudes about HL transmission might be more inclined to select after-school heritage language classes or bilingual schools over English-only schooling.

For the association between children's abilities in Mandarin and children's experience with Mandarin (research question 2), we expect an effect of both home language use and schooling. In line with the studies reviewed in our introduction, we expect children who use Mandarin more frequently at home and children who receive Mandarin instruction (either in heritage language classes or at bilingual schools) to outperform children with less Mandarin use at home and with no Mandarin instruction. It is also possible that the effect of schooling will be more pronounced for vocabulary development rather than for *wh*-questions: whereas vocabulary is highly dependent on the quantity and quality of exposure across many years (Montrul, 2022, p. 59–60), *wh*-questions are acquired in early childhood and are frequent in parent-child interactions.

Methods

Participants

Parents

To answer our research questions, we collected data from 34 families of Chinese origin residing in Alberta. The parents were born and raised in Mainland China and immigrated to Canada in adulthood, except for two fathers who immigrated to Canada at the age of 12, and one stepfather of Canadian origin (no immigration background). All parents of Chinese origin were native speakers of Mandarin Chinese and, based on a self-rating scale, they spoke English with varied degrees of proficiency. Importantly, in order for parents to participate in our study they had to speak Mandarin at home to some extent.

When asked about the significance of Mandarin language transmission, they showed generally very positive attitudes both toward the significance of speaking and understanding and the significance of reading and writing. More details on parental characteristics appear in the Parental Questionnaire section of Tasks and in Table 1.

Children

The children ($N = 47$) were either born in Canada ($N = 36$) or immigrated to Canada with their families in early childhood ($N = 11$). In terms of family structure, all children lived with both parents, and some of them also had siblings ($N = 22$) and/or grandparents ($N = 20$). The children were first exposed to schooling in English between the ages of 1.5 and 5.5, and they used Mandarin with their family to varying degrees.

In terms of Mandarin instruction, the children belonged to three groups. There were 11 children who attended English-only schools (henceforth, the *English school* group); 21 children who attended English-only schools but also after-school heritage Mandarin classes (*Heritage school*), either with a private tutor or in a community school operating on weekends; and 15 children who attended English-Mandarin bilingual schools (*Bilingual school*).

Children in the *English school* group received no Mandarin instruction at the time of testing. Children in the *Heritage school* group received Mandarin instruction for a few hours per week (1–4 h). Finally, children in the *Bilingual school* group received Mandarin instruction for ~9.5 h per week in the case of elementary school students (around ages 6–12), or for ~4 h per week in the case of junior high (around ages 12–15) and high school students (around ages 15–18).

Participants in the *Heritage* and *Bilingual school* groups differ not only in the average amount of Mandarin instruction (i.e., hours per week), but also in the type of Mandarin instruction that they offer. In heritage schools, Mandarin is taught directly as the subject of study. In bilingual schools, Mandarin is used (along with English) as the medium of instruction (Wu, 2005; Lin, 2023). The proportion of Mandarin instruction is 50% in elementary school, but decreases to 25 and 20% in junior high and high school, respectively. More details concerning children's demographics and language practices (per school type and as a group) are provided in the first section of Tasks and in Table 2.

TABLE 1 Parental characteristics (mean, range, and standard deviation).

	Mothers ($N = 34$)	Fathers ($N = 34$)
Age (in years)	43.40	47.09
	35–51	36–58
	4.39	5.51
SES (0–24)	18.29	19.41
	11–24	14–24
	2.64	2.28
English proficiency (0–4)	2.44	2.64
	1–4	0–4
	0.82	0.98
Mandarin proficiency (0–4)	4	3.88
	4–4	1–4
	0	0.53
Attitudes_Speak and Understand (0–4)	3.85	3.69
	3–4	2–4
	0.35	0.64
Attitudes_Read and Write (0–4)	3.23	3.3
	2–4	1–4
	0.72	0.88

Age, chronological age; SES, socioeconomic status, corresponding to years of education; English Proficiency, parental proficiency in English, based on a self-rating scale from 0 (not fluent) to 4 (native speaker); Mandarin Proficiency, parental proficiency in Mandarin, based on a self-rating scale from 0 (not fluent) to 4 (native speaker); Attitudes_Speak and Understand, parental attitudes concerning the importance of speaking and understanding Mandarin, based on a rating scale from 0 (very much disagree (negative opinion)) to 4 (very much agree (positive opinion)); Attitudes_Read and Write, parental attitudes concerning the importance of reading and writing in Mandarin, based on a rating scale from 0 (very much disagree (negative opinion)) to 4 (very much agree (positive opinion)).

Tasks

Parental questionnaire

To collect background information about our participants, we used the ALEQ_Heritage (Daskalaki et al., 2019), an adaptation of the Alberta Language and Environment Questionnaire (Paradis, 2011). Besides general demographic information (e.g., age, AoA of English), the questionnaire also asks about information on parental characteristics (SES, L1 and L2 proficiency, and attitudes), as well as on the amount/type of Mandarin instruction and Mandarin language use at home.

Information on parental characteristics was collected as follows. For SES, parents were asked to report the number of years of education they had received. Note that the vast majority of the parents (28/34 mothers and 33/34 fathers) had received at least 18 years of education, which in our scale corresponds to an undergraduate university degree. For English and Mandarin proficiency, parents were asked to rate their proficiency on a scale from 0 (not fluent) to 4 (native speaker). For attitudes, parents were presented with two statements concerning the significance of

TABLE 2 Children's characteristics (as a group and per school type; mean, range, and standard deviation).

	Full sample	English school	Heritage school	Bilingual school
	(N = 47)	(N = 11)	(N = 21)	(N = 15)
Age (in months)	125.7	124	133.1	116.5
	81–194	83–193	81–194	87–188
	34.24	38.3	30.59	35.96
AoA (in months)	44.46	45.27	43.4	45.27
	11–68	20–65	11–68	25–64
	14.26	15.51	14.98	13.17
Mand_Use_Home (0–4)	2.82	2.43	2.81	3.11
	0.5–4	0.5–4	1.66–3.75	1.2–4
	0.84	1.17	0.63	0.76
Mand_Use_Mother (0–4)	3.07	2.54	3.23	3.23
	1–4	1–4	2–4	2–4
	0.87	1.1	0.75	0.72
Mand_Use_Father (0–4)	3.15	2.63	3.19	3.5
	0–4	0–4	2–4	2–4
	0.93	1.34	0.76	0.62
Mand_Use_Grandparents (0–4)	3.97	3.9	4	4
	3.5–4	3.5–4	4–4	4–4
	0.11	0.2	0	0
Mand_Use_Siblings (0–4)	1.78	1.87	1.66	1.87
	0–4	0–4	0–3	0–4
	1.26	1.63	1.06	1.26
Mand_Instruction_Current (hours per week)	3.45	0	2.09	7.9
	0–9.5	0–0	1–4	3–9.5
	3.57	0	0.88	2.75

Age, chronological age; AoA, age of systematic exposure to English schooling; Mand_Use_Home, the average Mandarin input and output that the child received from and directed to other family members (parents, grandparents, and siblings) at home; Mand_Use_Mother, the average Mandarin input and output that the child received from and directed to their mother; Mand_Use_Father, the average input and output that the child received from and directed to their father; Mand_Use_Grandparents, the average Mandarin input and output that the child received from and directed to their grandparents; Mand_Use_Siblings, the average Mandarin input and output that the child received from and directed to their siblings; Mandarin_Instruction_Current, number of hours of Mandarin instruction per week, at the time of testing.

Mandarin language transmission, and were asked to indicate the extent to which they agreed with each statement on a scale from 0 (very much disagree) to 4 (very much agree). The first statement concerned the significance of oral skills (“It is my priority that my children learn how to speak and understand Mandarin”), whereas the second statement concerned the significance of literacy skills (“It is my priority that my children learn how to read and write in Mandarin”). Notably, the parents overwhelmingly believed in the importance of Mandarin language transmission: 65 out of 68 parents (34 mothers, 31 fathers) agreed or strongly agreed that it is important for their children to learn how to speak and understand Mandarin, and 56 out of 68 parents (29 mothers and 27 fathers) agreed or strongly agreed that it is important for their children to learn how to read and write in Mandarin. All remaining parents expressed neutral attitudes, except for one father who questioned the value of Mandarin literacy skills. In general, these highly positive attitudes toward Mandarin transmission are in line with

conclusions reported in qualitative studies with Chinese immigrant parents (e.g., Zhang and Slaughter-Defoe, 2009; Hu et al., 2014; Liang and Shin, 2021). Descriptives for parental characteristics are provided in Table 1.

Turning to language use measures, parents were asked to indicate the relative use of English vs. Mandarin between their child and each family member residing at home (mother, father, grandparents, and siblings) on a scale of 0 to 4 (0 = English almost always to 4 = Mandarin almost always). Subsequently, we calculated an average score for Mandarin use across all family members (Mand_Use_Home), as well as individual averages for child-mother (Mand_Use_Mother), child-father (Mand_Use_Father), child-grandparents (Mand_Use_Grandparents), and child-siblings (Mand_Use_Siblings) interactions. This was to better understand how Mandarin and English were used differently among different family members. As shown in Table 2, children used Mandarin

the most with their grandparents and the least with their siblings, whereas Mandarin use with the mother and father held an intermediate status.

Vocabulary task

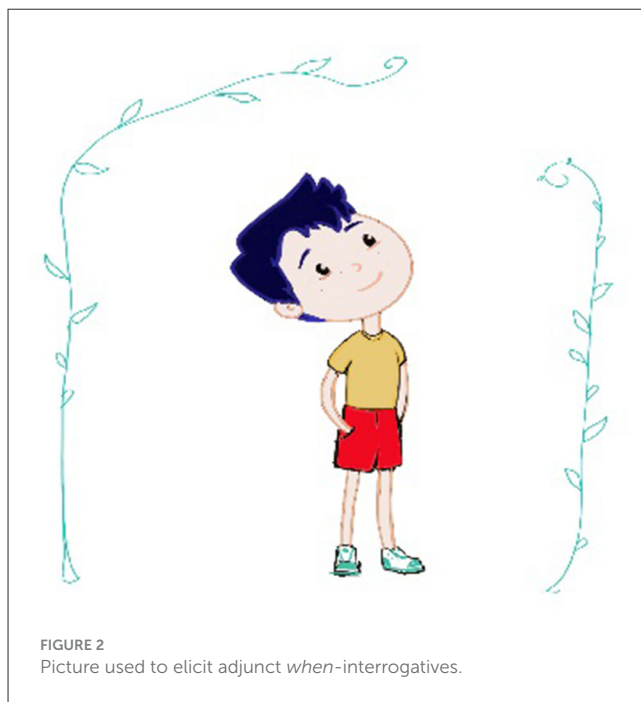
The picture-naming component of the Mandarin Cross-linguistic Lexical Task (CLT; Kuo, 2022) was used to assess children’s vocabulary. Children were presented with a total of 64 pictures on a PowerPoint presentation (32 pictures targeting nouns followed by 32 pictures targeting verbs). After each picture, the children were asked to name the object (for the noun targets) or activity (for the verb targets) depicted on the screen. For example, to elicit the noun *chènshān* “dress shirt,” children were presented with a picture of a dress shirt and were asked to name the object that they saw (e.g., *Zhè shì shénme?* “What is this?”). To elicit the verb *diàoyú* “to fish,” children were presented with a picture of a girl fishing and were asked to name the activity carried out by the girl (*Zhè-gè nǚhái zài gànshénme?* “What is the girl doing?”). Correct responses were assigned the value 1, whereas incorrect responses were assigned the value 0. Correct responses involved the target form as well as synonyms and regional variants. To use the same example as above, for the picture of a dress shirt, the target word was *chènshān*, but the synonym *chènyī* was also accepted. Incorrect responses consisted primarily of no responses and semantic deviations, such as the use of hypernyms. For example, for the dress shirt picture, the hypernym *yīfú* “clothes” was considered incorrect.

Elicited production task

To assess children’s *wh*-interrogatives, we used Daskalaki et al.’s (2023) elicited production task. This task was modeled on previous studies on *wh*-interrogatives (e.g., Strik and Pérez-Leroux, 2011; Guasti et al., 2012; Yatsushiro et al., 2022). It consists of a total of 27 items: three practice items, eight fillers, and 16 experimental items. Of the experimental items, eight targeted object-interrogatives and eight targeted *when*-interrogatives.

To prompt the production of object-interrogatives, children were shown a picture of a little boy named John who was carrying out an activity on one of his pets (e.g., chasing it). Crucially, the pet was covered (Figure 1) so the child was invited to ask a question to find out who John was doing the activity to. The expected response was an interrogative sentence containing an *in-situ* (post-verbal) object. A sample dialogue is provided in (8). Note that though the object presented here is the interrogative pronoun *shéi* “who,” a correct answer could also use the interrogative demonstrative phrase *nǎ-yī-zhī* “which one,” or some variant thereof.

- (8) a. Experimenter: Yuēhàn zhuī-zhe tā-de chǒngwù, dānshì nǐ kàn-bú-jiàn shì nǎ-yī-zhī. Nǐ kěyǐ wèn wǒ shì shéi ma? Wǒ zhīdào dáàn, yě néng gào sù nǐ. “John is chasing his pet, but you can’t see which one it is. Can you ask me who it is? I know the answer and I can tell you.”



- b. Target Interrogative: Yuēhàn zài zhuī-zhe shéi?
John PROG chase-CONT who
“Who is John chasing?”

To prompt the production of *when*-interrogatives, children were shown a picture of the same boy John (Figure 2), and were told that one of his friends had interacted with his rabbit (e.g., the friend had chased John’s rabbit). The child was invited to ask a question to find out when this activity took place. The expected response was an interrogative sentence containing the *in-situ* (preverbal) question phrase *shénme shíhòu* “when” (lit. “what time”). A sample dialogue is provided in (9).

- (9) a. Experimenter: Yuèhàn gēn wǒmén shuō tā-de péngyǒu Bǎoluó zhuī le tā-de tùzi, dànsì tā méi gēn wǒmén shuō tā shì shěnmé shíhòu. Nǐ kěyǐ wèn wǒ shì shěnmé shíhòu ma?
“John told us that his friend Paul chased his rabbit, but he did not tell us when. Can you ask me when it was?”

- b. Target Bǎoluó shěnmé shíhòu zhuī le tùzi?
Interrogative: Paul what time chase PFV rabbit
“When did Paul chase the rabbit?”

Correct responses were assigned the value 1 and incorrect answers were assigned the value 0. Correct responses included the use of *in-situ* question words (pronouns, demonstratives, *when*, etc.), whereas incorrect responses included the use of fronted question words. Incomprehensible or alternative responses, no responses, and responses with English verbs were coded as NA and were excluded from the calculation.

Procedures

Testing

The measures in the present study were part of a larger battery of linguistic tests. Testing took place online, via Zoom, and lasted ~50 min. Participants were asked to be in a quiet room at the time of testing. All the tasks were administered by a research assistant who was a bilingual speaker of Mandarin and English. The research assistant used the function “Share screen” to display the PowerPoint presentation of the vocabulary and the elicited production task. At the end of the session, the research assistant delivered the ALEQ in an interview format, either in Mandarin or in English (depending on the parents’ preference). All the tasks, besides the ALEQ, were audio-recorded.

Coding

Two native speakers of Mandarin transcribed and scored the recordings for vocabulary and *wh*-interrogatives. A third speaker re-coded 20% of each one of the tasks. The results were compared to obtain the percentage of inter-rater agreement. For the vocabulary task, there was a 95.6% agreement rate, whereas for the *wh*-interrogative task, it was 100%.

Ethics

The protocols for this study were approved by the ethics board of the University of Alberta (protocol number Pro00105886). Since all participants were minors, their parents provided electronic consent for participating in the study. In addition, participants themselves provided oral assent during the testing session.

Data analysis

Data analysis was carried out using the R statistical software (version 4.3.2; R Core Team, 2020). Visualizations were performed using the ggplot2 package (Wickham, 2016).

To address research question 1a, namely the association between parental characteristics and home language use, we ran cumulative link models, using the ordinal package (Christensen, 2018). To address research question 1b, namely the association between parental characteristics and school selection, we ran multinomial logit models, using the nnet package (Venables and Ripley, 2002). Because the multinomial package does not include *p*-value calculation, we calculated *p*-values using Wald tests. In both the cumulative link models and the multinomial models, we started by including the two predictors of interest as our two fixed effects (attitudes and English proficiency). We then followed backwards selection, eliminating the fixed effect with the highest *p*-value if it was above the $p = 0.05$ threshold. For these models on the association between parental characteristics and children’s language experiences, we followed Gathercole and Thomas (2007) in running separate analyses for mothers and fathers.

For the association between language use and Mandarin proficiency (research questions 2a and 2b), we ran generalized mixed effects regression models with a binomial distribution using the lme4 package (Bates et al., 2015). For all binomial models, we began with a maximally-specified random-effect structure that had to be pared down due to convergence issues. In the end, all models included one random intercept for Participant and one for Item. We specify the fixed effects structure in the Results section below. Following the previous models, we also followed backwards selection on the fixed effects.

All numerical predictors were scaled and centered. Model comparisons were performed using likelihood ratio tests. The analyses and the optimal models are presented in detail in the Results section.

Results

The association between home language use and parental characteristics

To examine the association between Home Language Use and parental attitudes and English proficiency (research question 1a), we ran two cumulative link models, which handle ordinal data appropriately.

The first model focused on mothers. The outcome variable was the mean Mandarin input and output that the child received from/directed to their mother at home. The ordinal scale was 0–4 (0 = always English; 4 = always Mandarin). The fixed effects included: (i) maternal attitudes toward their child learning to speak and understand Mandarin (Maternal_Attitudes_Speak_Understand), and (ii) the mother’s proficiency in speaking/understanding English (Maternal_English_Proficiency).

There was a significant effect of maternal English proficiency: higher English proficiency was associated with lower Mandarin use in child-mother interactions. There was also a marginally significant effect of maternal attitudes: positive maternal attitudes

TABLE 3 Optimal model for the association between maternal characteristics and the amount of Mandarin language use in child-mother interactions.

	Estimate	Std. error	z-value	Pr(> z)
Maternal_Attitudes_Speak_Understand	0.528	0.277	1.902	0.057
Maternal_English_Proficiency	-1.442	0.371	-3.891	<0.001***

*** $P \leq 0.001$.

TABLE 4 Optimal model for the association between paternal characteristics and the amount of Mandarin language use in child-father interactions.

	Estimate	Std. error	z-value	Pr(> z)
Paternal_Attitudes_Speak_Understand	0.973	0.288	3.376	<0.001***
Paternal_English_Proficiency	-1.215	0.389	-3.120	0.002**

** $p < 0.01$; *** $P \leq 0.001$.

were associated with more Mandarin language use in child-mother interactions (see Table 3).

The second model focused on fathers. The outcome variable was the mean Mandarin input and output that the child received from/directed to their father at home. The ordinal scale was 0–4. The fixed effects included: (i) paternal attitudes toward their child learning to speak and understand Mandarin (Paternal_Attitudes_Speak_Understand), and (ii) the father's proficiency in speaking/understanding English (Paternal_English_Proficiency).

Both paternal attitudes and English proficiency emerged as significant (Table 4). That is, positive paternal attitudes were associated with more Mandarin language use in child-father interactions, whereas higher English proficiency was associated with less Mandarin language use in child-father interactions.

The association between school type and parental characteristics

To examine the association between school type (*English school*, *Heritage school*, and *Bilingual school*) and parental characteristics (research question 1b), we used multinomial logit models, which are appropriate for categorical variables with more than two categories. We followed the same procedure as above and examined the effect of maternal characteristics separately from the effect of paternal characteristics. Note that for parental attitudes in these models, we used parents' attitudes toward their children's literacy skills rather than their oral communication skills (which were used in the previous models). This is because we assume that the parents' decision to enroll their children in HL schooling may be primarily driven by literacy factors.

In the model focusing on mothers, fixed effects included: (i) maternal attitudes toward their child learning how to read and write Mandarin (Maternal_Attitudes_Read_Write), and (ii) maternal English proficiency (Maternal_English_Proficiency). None of these factors emerged as significant. In other words, neither maternal attitudes nor English proficiency influenced the likelihood of choosing a heritage or bilingual school over an English school. Furthermore, changing the reference level to heritage school demonstrated that maternal characteristics did not influence the

likelihood of choosing an English school or bilingual school over a heritage school.

In the model focusing on fathers, fixed effects included (i) paternal attitudes toward their child learning how to read and write Mandarin (Paternal_Attitudes_Read_Write), and (ii) paternal English proficiency (Paternal_English_Proficiency). Similarly to the maternal model discussed above, the paternal model revealed that neither paternal attitudes nor English proficiency influenced the likelihood of choosing a heritage or a bilingual school over an English school. Changing the reference level to heritage school though demonstrated that there was a marginally significant association between paternal attitudes and school type. Specifically, stronger paternal attitudes marginally increased the likelihood of choosing a bilingual school over a heritage school (Table 5).

The effect of Mandarin use (at home and at school) on Mandarin vocabulary and Mandarin syntax (*wh*-interrogatives)

Our second research question concerned the effect of Mandarin language use (operationalized as Mandarin use at home and at school type) on children's Mandarin abilities. To address this question, we operationalized schooling as a categorical variable (e.g., Bylund and Díaz, 2012) rather than as a continuous variable (e.g., Rodina et al., 2020). The decision to operationalize schooling categorically, rather than quantitatively, was driven by the fact that 1 h of heritage language class cannot be directly compared to 1 h of bilingual instruction (see Methods). In addition, participants were distributed relatively evenly among the three types of schools, whereas the same cannot be said for the entire range of hours of instruction.

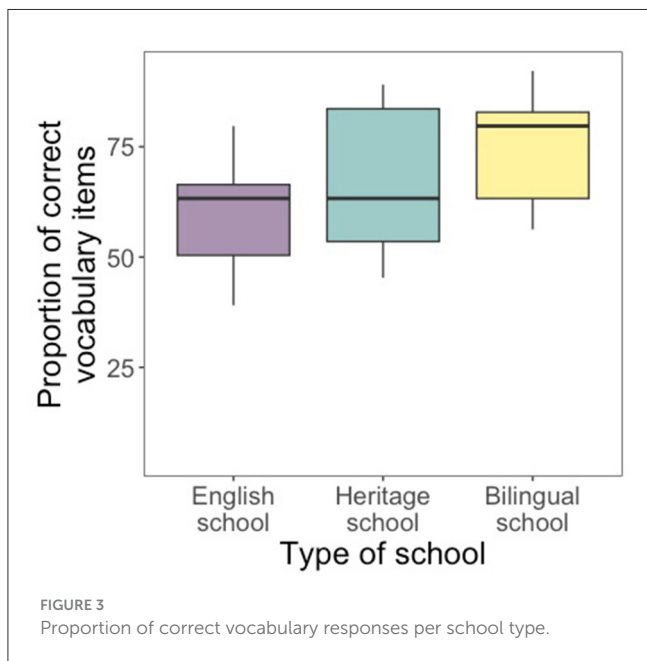
Separate analyses were run for vocabulary and syntax.

Vocabulary

To examine the effect of HL use (at home and school) on vocabulary (research question 2a), we first explored our data descriptively. Figure 3 shows the spread of the children's Mandarin vocabulary scores by the type of school they attended. As the visualization suggests, the Bilingual school group had a higher median vocabulary score than the other two groups. As well,

TABLE 5 Optimal model for the association between paternal characteristics and school type.

Fixed effects	English school		Pr(> z)	Bilingual school		Pr(> z)
	Estimate	Std. error		Estimate	Std. error	
Paternal Attitudes_Read_Write	0.1854	0.442	0.675	0.791	0.468	0.091



the Heritage school group demonstrated greater variation in performance than the children from the other two types of schools.

To further explore if the observed differences were statistically significant, we ran a mixed-effects logistic regression model with a binomial distribution. In this model, the outcome variable was Accuracy, with values 1 for correct and 0 for incorrect. The fixed effects included: (i) schooling, which was a three-level factor (English school; Heritage school; Bilingual school); (ii) the amount of Mandarin language use at home, which was a continuous variable corresponding to the mean Mandarin input and output that the child received from/directed to all the other family members at home (Mand_Use_Home); and (iii) the interaction between schooling and the amount of language use at home. Age and AoA were also included as co-variables.

Results revealed a significant effect of Mandarin language use at home (more Mandarin use at home was associated with a higher likelihood of a correct item response) as well as a significant effect of schooling. In order to unpack the effects of school type, we carried out *post-hoc* comparisons with a Tukey adjustment with the package emmeans. These pairwise contrasts revealed that the only significant difference was between the English and Bilingual school groups ($p = 0.023$), with the Bilingual group showing a higher likelihood of producing a correct item response. There was also a marginal interaction between Mandarin language use at home and schooling ($p = 0.055$), suggesting that the effect of home language use was less pronounced for children attending a bilingual school. However, a likelihood ratio test revealed that there were no significant differences between the simple model (without the

TABLE 6 Optimal model for the effect of home language use and type of schooling on vocabulary.

	Estimate	Std. error	z-value	Pr(> z)
(Intercept)	0.771	0.439	1.755	0.079
School type_ Bilingual school	1.111	0.422	2.631	0.008**
School type_ Heritage school	0.567	0.390	1.454	0.146
Mand_Use_Home	0.821	0.174	4.715	<0.001***
Age	0.537	0.169	3.177	0.001**

The reference level for school type is English school. ** $p < 0.01$; *** $P \leq 0.001$.

interaction) and the more complex model (with the interaction). Therefore, Table 6 presents the estimates for the simpler model. Of the co-variables, only Age emerged as significant (older age was associated with a higher likelihood of providing the target item).

Syntax

Similar analyses were applied to examine the effect of HL use (at home and school) on syntax (research question 2b). Figure 4 shows the proportion of the children's *in-situ* vs. fronted interrogative responses by the type of school they attended. In the case of object-questions, the English school group showed much greater variation in performance, while the Bilingual school and Heritage school groups were at ceiling. In the case of *when*-questions, the children attending Heritage schools performed better than the children attending Bilingual or English schools.

To determine whether these differences are statistically significant, we ran again a mixed-effects logistic regression model with a binomial distribution. In this model, the outcome variable was Accuracy, with values 1 for accurate (*in-situ*) responses and 0 for inaccurate (fronted) responses. The fixed effects included: (i) Condition, which was a two-level factor (object-questions and *when*-questions); (ii) schooling (English school; Heritage school; Bilingual school); (iii) the amount of Mandarin language use at home (Mand_Use_Home); and (iv) the interaction between schooling and home language use. Age and AoA were also included as co-variables.

Results revealed a significant effect of Condition (accuracy was lower with *when*-interrogatives) and a significant effect of home language use, in that children who used Mandarin at home more often were more likely to produce grammatical *in-situ* responses. Of the co-variables, Age emerged as significant (older age was associated with higher accuracy). The estimates of the optimal model are presented in Table 7; note that school type is not in the optimal model given it did not reach significance.

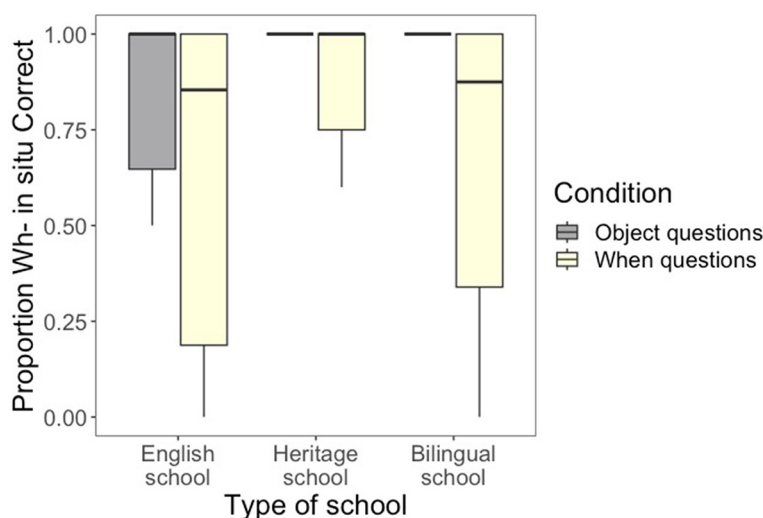


FIGURE 4
Proportion of *in-situ* responses per school type and condition.

TABLE 7 Optimal model for the effect of Mandarin home language use and type of schooling on *wh*-questions.

	Estimate	Std. error	z-value	Pr(> z)
(Intercept)	6.624	0.942	7.029	<0.001***
Condition_When_Questions	-3.879	0.567	-6.840	<0.001***
Mand_Use_Home	3.168	0.731	4.336	<0.001***
Age	2.063	0.683	3.020	0.002***

*** $P \leq 0.001$.

Discussion

This study examined the association between parental characteristics, children's HL experiences, and children's HL abilities among Mandarin-English bilingual children, who were enrolled in three different types of schooling in western Canada (English-only schools, English-only schools with after-school HL classes, and Mandarin-English bilingual schools). Our specific objectives were as follows: (i) to determine whether parental attitudes and proficiency affect children's experiences with their HL (at home and at school), and (ii) to determine whether children's HL experiences (at home and at school) affect children's HL abilities in vocabulary and simple syntax (*wh*-questions). Results, broken down by research objective, are discussed below.

The association between parental characteristics and children's language experiences

Our preliminary descriptive analyses on parental characteristics showed that the parents spoke English with varying degrees

of proficiency, and overall held very positive attitudes toward Mandarin transmission. To further explore whether parental attitudes and proficiency affect children's experience with their HL, we conducted a number of inferential analyses. Results revealed that there were indeed significant associations between parental attitudes and proficiency and home language use (in line with results reported in Altman et al., 2014 for attitudes and Gathercole and Thomas, 2007 for proficiency), and marginally significant associations between parental attitudes and school selection.

The association between parental characteristics and home language use

To begin with the associations between parental characteristics and home language use, we found that more positive parental attitudes and lower English proficiency were associated with increased Mandarin use at home. In particular, more positive maternal attitudes and lower English proficiency were associated with more frequent use of Mandarin in child-mother interactions (though for attitudes, the effect was only marginal). Accordingly, more positive paternal attitudes and lower English proficiency were associated with more frequent use of Mandarin in child-father interactions.

In addition to providing empirical evidence for the role of parental characteristics, these results have two important implications. First, they support the conclusion that not only maternal but also paternal characteristics can be implicated in shaping children's experience with their HL at home. Thus, they complement previous studies suggesting that the linguistic background of both parents needs to be taken into consideration (see, for instance, Hammer et al., 2012). Secondly, they show that the degree to which family members use their HL does not depend solely on parental attitudes. The family members' level of comfort with their two languages, such as their proficiencies, may play an equally important role.

The association between parental characteristics and school type

Turning to the association between parental characteristics and school type, we found only a marginal effect of paternal attitudes, such that fathers with more positive attitudes were more likely to choose a Bilingual school over a Heritage school for their children. All the other associations in both the maternal and the paternal models were insignificant. The absence of significant associations could be due to a couple of reasons:

First of all, parents were asked to report their attitudes concerning the significance of Mandarin transmission (reading and writing) at the time of testing and not at the time of school selection. Attitudes, however, are not a static construct. It is possible that these parents' attitudes became stronger/weaker over time depending on the family's experience, after school selection had taken place. Indeed, there is evidence coming from Spanish-speaking families in Toronto suggesting that immigrant parents with a longer residency in Canada have more positive attitudes concerning Spanish maintenance compared to more recent arrivals (Pérez-Leroux et al., 2011).

A second consideration concerns our sample. In order for parents to participate in our study they had to speak Mandarin at home to some extent. This decision was made so as to ensure that the children would have a certain level of Mandarin proficiency and would be able to complete our language tasks. As a result of our selection criteria, our sample may have been biased in favor of parents with positive attitudes. A sample of parents with a wider range of attitudes may have yielded different results with respect to the factors influencing school selection.

The association between children's language experiences and children's language abilities

Having established that parental characteristics may affect children's HL experiences, we proceeded to examine how children's HL experiences affect children's HL outcomes. We hypothesized that the effect of home language use and schooling might depend on the target domain, a hypothesis that was confirmed by our results: whereas children's vocabulary abilities were influenced by both home language use and schooling, children's production of *wh*-interrogatives were influenced solely by home language use. This is presumably because *wh*-interrogatives are highly frequent in child-parent interactions, whereas abstract vocabulary comes from print exposure and reading experience (Montrul, 2022). In what follows, we consider the models targeting vocabulary and syntax in more detail.

The association between children's language experiences and children's vocabulary

In the model targeting vocabulary, children's abilities were affected by both home language use and type of schooling. Specifically, participants in the Bilingual school group outperformed participants in the English school group (in line with Gathercole, 2002), and all children benefited from

Mandarin use at home, independently of school type. Interestingly, though, there was no statistically significant difference between the Heritage school and English school groups (contra Bylund and Díaz, 2012).

The bilingual schooling effect is consistent with our hypothesis. In bilingual schools, Mandarin is the medium of instruction and, consequently, students have the opportunity to familiarize themselves with vocabulary items from a wide variety of topics in math, social sciences, and language arts. It is, therefore, unsurprising that Bilingual school students outperformed English school students on our vocabulary tasks. The lack of an advantage for participants attending Heritage schools is harder to explain, however. One possibility comes from Li et al. (2021), who investigated the receptive vocabulary scores of first-grade Mandarin and Cantonese HSs in Canada, and who similarly found no difference between the scores of children who attended HL schooling and those who did not. The authors suggested this might be due to the generally low quality of instruction in after-school HL classes. Some other possible explanations we propose are that a heritage school advantage might be more visible in tasks that implicate literacy skills (e.g., cloze tests and grammaticality judgment tasks, similar to those used in Bylund and Díaz, 2012); that the vocabulary taught in heritage schools might not be significantly different from the vocabulary that children already learn from naturalistic exposure at home; or that heritage school children simply spend too few hours per week in HL classes, such that there is no measurable gain in vocabulary from a small amount of formal instruction.

Lastly, there was a marginal interaction between type of schooling and home language use, indicating that the effect of Mandarin use at home may be less pronounced for children attending Bilingual schools (in line with patterns reported in Jia and Paradis, 2015). In principle, this trend suggests that Mandarin instruction may play a protective role against variability in Mandarin use in the home context and should be further investigated in future studies with larger sample sizes.

The association between children's language experiences and children's syntax (*wh*-interrogatives)

Turning to the models targeting syntax, we found, first of all, an effect of Condition. In particular, children were more likely to produce fronted *wh*-words in *when*-questions than in object-questions (in line with results reported in Daskalaki et al., 2023). The differential vulnerability of the two conditions to CLI from English could be due to the fact that *wh*-words have a more variable distribution in Mandarin *when*-questions than in Mandarin object-questions. Whereas in Mandarin object-questions *wh*-fronting is ungrammatical, in Mandarin *when*-questions *wh*-fronting is merely dispreferred, creating a context of structural overlap.

Interestingly, of the two environmental factors (Mandarin language use at home and Mandarin schooling), only the former was found to mitigate CLI from English. In particular, the rate of *wh*-fronting decreased as a function of Mandarin language use at home. By contrast, schooling did not emerge as a significant factor. The differential contributions of home language use and schooling

resemble the results reported in [Chondrogianni and Daskalaki \(2023\)](#). Like [Chondrogianni and Daskalaki \(2023\)](#), we propose that frequent/early-acquired structures might be less reliant on external sources of input, presumably because they have been solidified through home language use.

The effect of age-related variables

Finally, special reference needs to be made to the age-related variables (age and AoA) that were included as co-variables in our analyses. In both the vocabulary and the syntax models, there was a positive age effect. This is in line with a number of studies showing that children's HL may continue to improve as children grow older and accumulate more HL input (e.g., [Flores et al., 2017b](#); [Jia and Paradis, 2020](#); [Daskalaki et al., 2022](#)). By contrast, there were no AoA effects, possibly due to the fact that all the children in our sample were exposed to English in early childhood (by the age of 5 years and a half).

Conclusions and implications

Taken together, the results of our study show that parental characteristics may influence input factors, which, in turn, may affect the acquisition of vocabulary and early-acquired syntactic structures in HLs. More specifically, we found that: (i) more Mandarin use at home is predicted by more positive parental attitudes toward Mandarin language transmission and by lower parental proficiency in English; and (ii) larger vocabulary size is predicted by both more home language use and more schooling, whereas greater accuracy for *wh*-questions is predicted solely by more home language use.

This study is one of the few quantitative studies demonstrating an association between attitudes and home language use. As such, it enhances our understanding of the relation between distal and proximal environmental factors ([Paradis, 2023](#)) by not only demonstrating that home language use matters for HL acquisition, but also that home language use is affected by parental factors. This study also contributes to ongoing discussions concerning the differential sensitivity of language domains to environmental factors ([Chondrogianni, 2023](#)) by showing that vocabulary relies more heavily on formal instruction than early-acquired syntactic structures (*wh*-interrogatives) do. Future studies may extend this line of research to examine how attitudes and proficiency shape HL use in the case of second-generation parents who are typically dominant in the ML, as well as how home language use and schooling affect later-acquired structures that are primarily used in formal registers (see, for instance, [Torregrossa et al., 2023](#)).

Finally, special reference also needs to be made to the applied implications of our study. Our results highlight the need to support immigrant families with HL programs, since the home environment on its own cannot offer the diversification of contexts needed for successful HL acquisition across all domains. We expect the need for instructional support to be even more pronounced for second-generation parents who may be less fluent in the HL, as well as for mixed families, in which only one of the two parents is an HL speaker.

Limitations

It is important to acknowledge the limitations of our study design. First, we should note that the Heritage school group is heterogeneous, in the sense that it includes children who were attending community schools as well as students who were attending private tutorials. Second, the data were collected during the pandemic, an extraordinary period in which instruction was interrupted and/or transitioned to remote modes of teaching. Thus, it is possible that the quality, and, consequently, the effect of HL schooling (in both Heritage schools and Bilingual schools) was compromised for reasons related to the characteristics of the instruction during that period. Finally, the sample was limited. This did not allow us to control for the role of the family in our statistical analyses.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#). Further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Research Ethics Board-University of Alberta. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

ED: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing. AS-C: Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. VX: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. JP: Conceptualization, Funding acquisition, Methodology, Writing – original draft, Writing – review & editing, Investigation, Supervision.

Funding

The author(s) declare financial support was received for the research, authorship, and/or publication of this article. This study was supported by (i) 2020–2024 Social Sciences and Humanities Research Council of Canada (SSHRC). Insight Development Grant: The bilingual development of immigrant children in Western Canada: Predictors and outcomes of crosslinguistic influence, E. Daskalaki (PI), J. Paradis (co-investigator), and A. Soto-Corominas (collaborator); (ii) Generalitat de Catalunya. SGR-Cat 2021, A. Soto-Corominas (PI).

Acknowledgments

The authors are grateful to all the children and their parents for their participation and enthusiasm. They would also like to thank Dalia Cristerna Román for coordinating the research team, as well as Padgett Hiew and Yuan Yuan Yang for assisting with data collection, transcription, and coding.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/flang.2024.1435200/full#supplementary-material>

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